FINAL REPORT

RAPIDLY SOLIDIFIED Fe-Al BRONZE POWDER

for

Dept. of Energy, Mines and Resources
CANMET
Physical Metallurgy Research Labs
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Att: Dr. L. Collins, Scientific Authority.

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Dept. of Energy, Mines & Resources
For Rapidly Solidified Fe-Al Bronze Powder

SUMMARY

This report describes conditions used to atomize three different compositions of aluminum bronze powder. The first three trials were conducted using helium as the atomizing gas through an annular atomizing nozzle. The fourth trial employed nitrogen as the atomizing gas while the fifth trial used nitrogen through a ring type of nozzle fitted with water jet orifices.

The products from all trials were separated into specific particle size fractions and were shipped to Energy, Mines and Resources, CANMET laboratories.

SOMMAIRE

Cet exposé décrit les conditions utilisées pour pulvériser trois différentes compositions de poudre d'aluminium-bronze. Les trois premiers essais etaient dirigés avec l'hélium comme le gaz pulvérisateur à travers dd'un ajutage pulvérisateur annulaire. Le quatrième essai employait l'azote comme le gaz pulvérisateur pendant que le cinquième essai utilisait l'a zote à travers d'un ajutage d'anneau monté avec une overture de gicleur d'eau.

Les produits de tous les essais furent divisés en fractions d'une paillette en grandeau spécifique et envoyés aux laboratoires CANMET de l'ENERGIE, MINES et RESSOURCES.

1. INTRODUCTION

Five (5) trials were carried out to produce samples of three separate compositions of aluminum bronze powder. Work was conducted under D.S.S. Contract Serial No. 23440-6-9148/01-SQ.

All samples of powders produced were shipped under separate cover to Energy, Mines and Resources, CANMET Laboratories in Ottawa.

2. TEST WORK AND RESULTS

2.1 Melt Preparation

The following three compositions were selected by CANMET personnel:

1 - Copper/6.5% Aluminum/3.6% Iron
2 - Copper/6.5% Aluminum/5.6% Iron
3 - Copper/6.5% Aluminum/7.8% Iron

The recovery of aluminum in the melt was estimated at 80% and an appropriate additional amount of aluminum was added to the charge.

Melting was accomplished in a 50 kW, 3 Hz Tocco induction furnace outfitted with a graphite crucible. Argon gas was used to protect the melt in all trials.

2.2 Atomization

Atomization trials #1 through #3 employed helium gas for atomization. An annular type atomization nozzle was used and a

surge tank was incorporated in the piping system to provide adequate pressure to the nozzle.

The powder collection vessel (Figure 1) was purged with Argon prior to atomization. A 3/32 inch orifice diameter alumina tundish nozzle was used for trials #1 through #3.

Trial #4 was conducted on the low iron alloy melt using nitrogen as the atomizing gas. All other conditions were similar to those used in trials #1 through #3.

Trial #5 was carried out using nitrogen gas to atomize the 5.6% (medium) iron containing alloy. A larger tundish nozzle (3/16" dia.) and a ring type atomizing fixture (Figure 2) with spray nozzles was used for this trial.

Atomizing parameters and product weights are summarized in Table 1.

3. DISCUSSION

Difficulty encountered in establishing a stable metal stream in runs #2 and #3 can be attributed to the higher iron content of the melt composition. The 3/32 inch diameter tundish orifice proved to be suitable for the 3.6% iron composition, marginally suitable for the 5.6% iron composition but not useable for the 7.8% iron composition.

The product from run #4 was contaminated with silicon powder from a previous run.

The annular atomizing nozzle, used for runs #1 through #4, was damaged during run #4. Therefore, a MKII-27° ring nozzle with six jet nozzles was used for run #5. A coarser powder resulted as the ring nozzle is less efficient than the annular nozzle.

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TABLE 1

Atomization Parameters and Powder Products

Atomization Parameter * \ Trial No.	1	2	3	4***	5
- Melt Composition	Al/Cu/Fe3.6	Al/Cu/Fe5.6	Al/Cu/Fe7.8	Al/Cu/Fe3.6	Al/Cu/Fe5.6
- Atomizing Media	HE	HE	HE	N2	N2
- Purge Media	AR	AR	AR	N2	N2
- Tundish Nozzle (inches)	3/32	3/32	3/32	3/32	3/16
- Melt Temp (°F)	2450	2600	2800	2700	2800
- Tundish Temp(°F)	3000	3000	3100	3100	3150
- Atomizing Pressure (psig)	300-100	250	250	120	300
- Product Weight (g)					
- Prime	8124	325**	350**	3370	7766
- Fines from Vessel	140	14	-	-	
- Fines from Duct	1206	157	100		
- Particle Size Distribution of Prime Product (% wt)					
+20 mesh	14.2	10.6	24.7	45.2	83.5
-20 +100 mesh	50.1	36.1	51.1		
-100 +325 mesh	30.5	41.9	19.4	50.8	16.2
-325 mesh	5.2	11.4	4.8	4.0	0.3

* Atomization parameters common to all trials:
- Annular nozzle used for all trials except #5 where a MK11-27° [6x4015 jets] was used.
- Charge weight - 11497 g used for all heats

** Melt froze in tundish prematurely

*** Sample #4 contaminated with silicon powder.

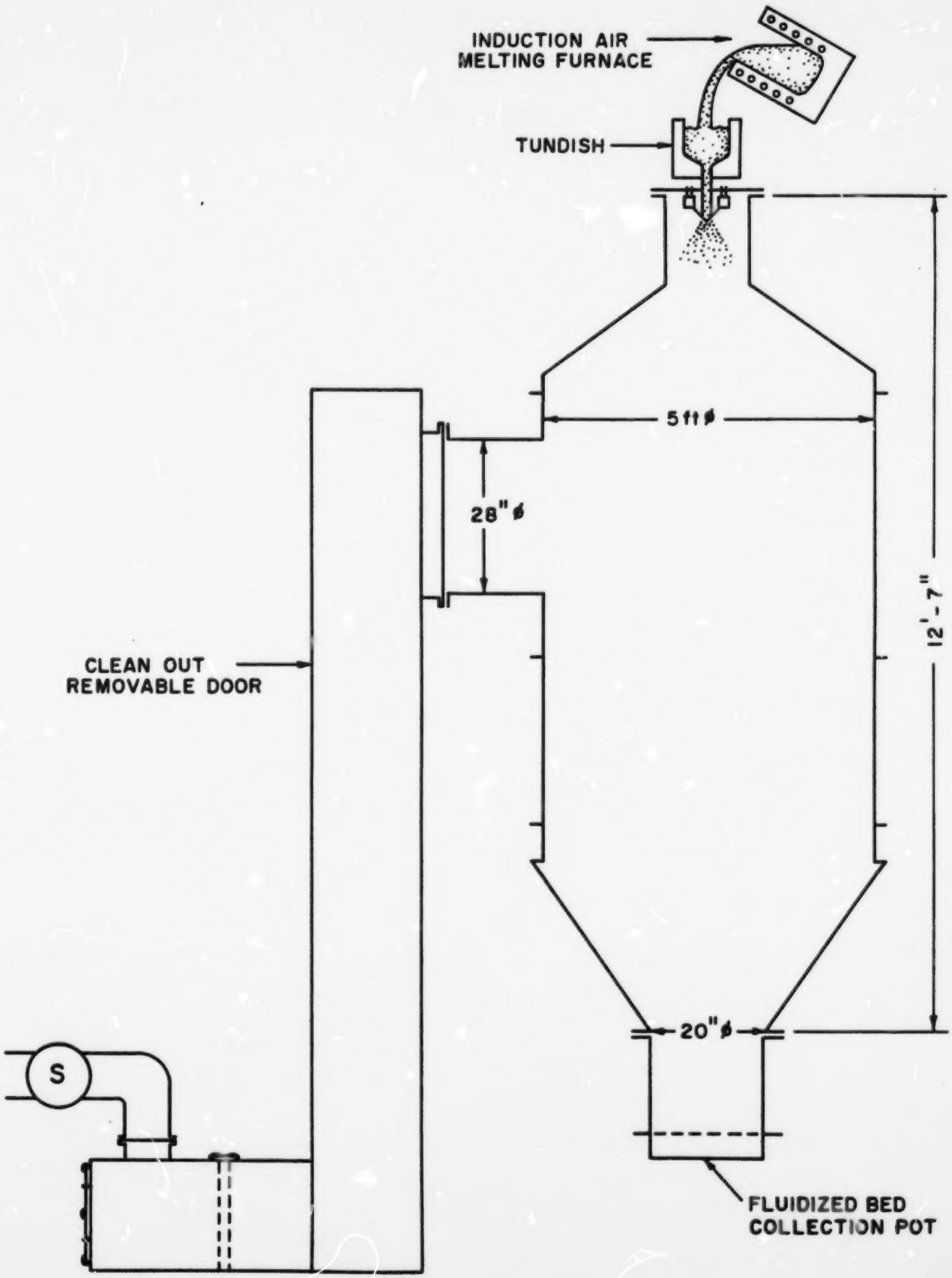
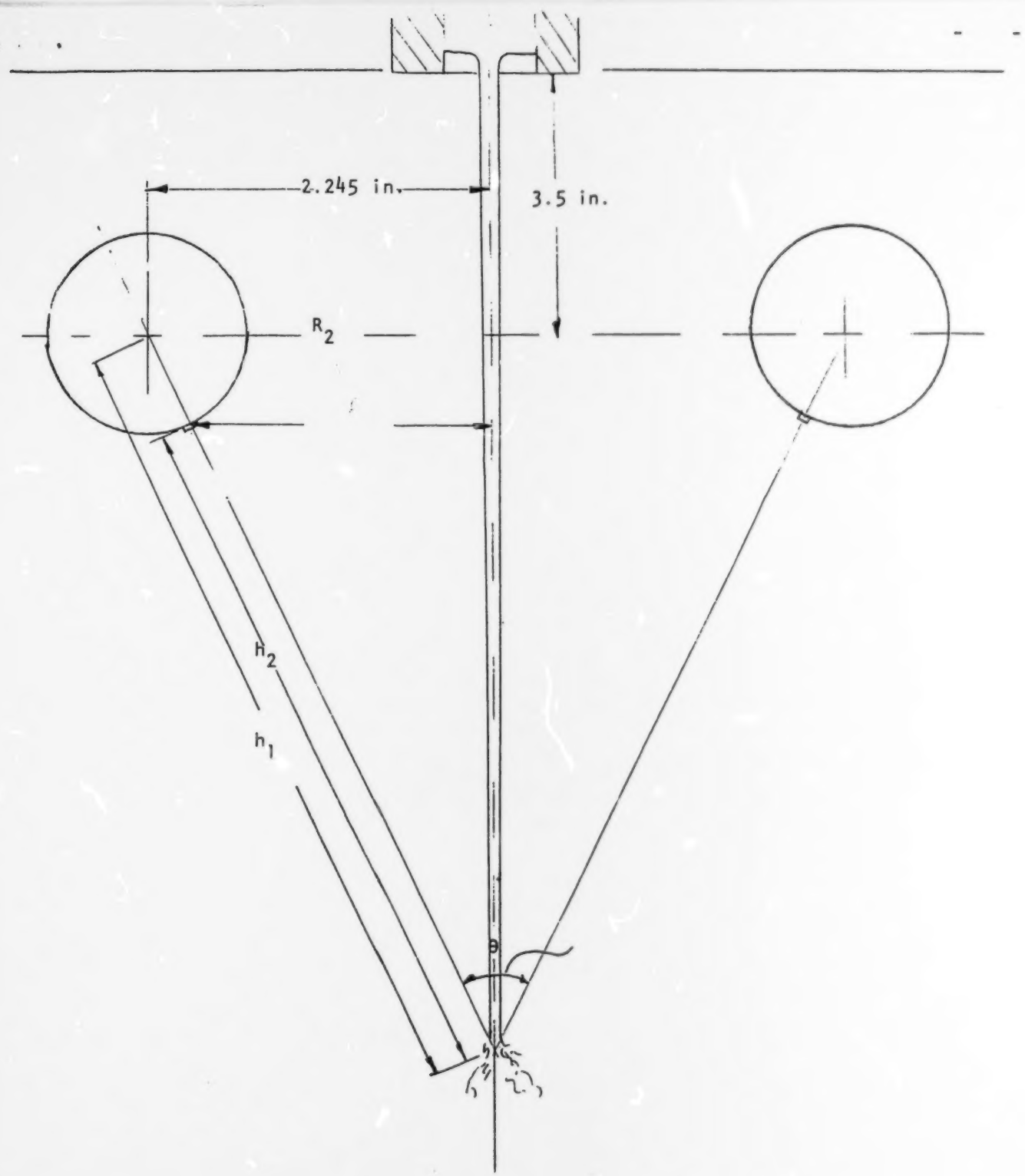


FIGURE 1 . GAS ATOMIZATION ARRANGEMENT



θ	h_1	h_2	R_2
27°	9.619"	8.654"	2.020"

FIGURE 2: Cross Sectional Geometry of Mark II Atomizing Nozzle